A newer approach in treating gummy smile- botulinum toxin: A review.

Anjali S. Nair[1], Sudipta Garain[1], Uttam Kumar Sen[2], Ankan Kumar Maji[3], Sanjit Lal Das[4], Shambaditya Pahari[5]

[1]Post Graduate Trainee, Department of Prosthodontics and Crown & Bridge, Haldia Institute of Dental Sciences and Research, West Bengal, India
[2]Principal, Department of Prosthodontics and Crown & Bridge, Haldia Institute of Dental Sciences and Research, West Bengal, India
[3]Professor, Department of Prosthodontics and Crown & Bridge, Haldia Institute of Dental Sciences and Research, West Bengal, India
[4]Head of the Department, Department of Prosthodontics and Crown & Bridge, Haldia Institute of Dental Sciences and Research, West Bengal, India
[5]Assistant Professor, Department of Prosthodontics and Crown & Bridge, Haldia Institute of Dental Sciences and Research, West Bengal, India

Abstract

Esthetics being a pillar of prosthodontics, it mandates the clinician to achieve a harmonious relationship of form and function along with esthetics of the patient. Excessive gingival display or the so called 'gummy smile' is frequently observed problem in day–to-day practice with patient willing to undergo a treatment that is less invasive yielding prompt results. One such method is the injection of botulinum toxin that can be used both as the sole treatment option and serves as an adjunct too. There are multiple studies done in the field of cosmetology showing the success of treatment with botulinum toxin. This article provides the details of mechanism of action of botulinum toxin, formulation of botulinum toxin and injection sites for treating excessive gingival display in a simple way so as to provide with a basic knowledge of the treatment procedure. Articles were searched through MEDLINE database and Google Scholar search engine. The keywords 'gummy smile', 'excessive gingival display', 'botulinum toxin', 'botox','botox in dentistry', 'botox in gummy smile' and 'botulinum toxin in gummy smile' were searched.

Keyword: Botulinum toxin, botox, excessive gingival display, gummy smile.

Address of correspondence: Dr. Anjali S. Nair, SaraswathyVilasom, Moothala, Pallickal, Thiruvanthapuram, Kerala- 695604
Email address: anjalisulabhanair@gmail.com **Phone no:** 9073240848. **DOI:** 10.5281/zenodo.5202837
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Introduction

One of the main concerns of a prosthodontist while performing an esthetic correction on a patient is the amount of excessive gingival display and opting for the appropriate treatment plan for the correction of the same. Several treatment options are available and one of the recent treatment options in use is the application of botulinum toxin. The use of botulinum toxin alone or with other methods has shown predictable results.

Botulinum Toxin or BOTOX (a misnomer however) has brought revolution in the field of cosmetology with promising outcomes. Alongside its corrective ramifications this mighty poison has likewise positively influenced in dentistry.

Botulinum toxin (BoNT) is a neurotoxic protein created by the bacterium *Clostridium botulinum* and related species.[1] It causes flaccid paralysis by preventing the release of neurotransmitter (acetylcholine) from the nerve endings at the neuromuscular junction.[2] It is the most dangerous poison known to man. It is 40 million times more toxic than cyanide.It has a potent biological effect: it is able to block the release of vesicular acetylcholine and consequently inhibits the muscle fibers activation.[3]

The seven principle sorts of botulinum poison are named types A to G. Types **A** and **B** are capable of causing disease in humans, and are also used both commercially and medically. Commercial forms are marketed under the brand names Botox (onabotulinumtoxinA), Dysport / Azzalure (abobotulinumtoxinA), Xeomin / Bocouture (incobotulinumtoxin A) and Jeuveau (prabotulinumtoxinA). The lethal dose estimated from primate studies of crystalline type A toxin for a 70 kg human is approximately 0.09 µg intravenously or intramuscularly, 0.70 – 0.90 µg inhalationally and 70 µg orally.[4]

Botox has shown its therapeutic effects in treating strabismus, hemifacial spasm, blepharospasm, cervical dystonia, spasmodic dysphonia, hyperhidrosis, sialorrhoea, Frey's symdrome, facial rejuvenations, temporomandibular disorders, post-herpetic and trigeminal neuralgias and chronic migraine headaches.

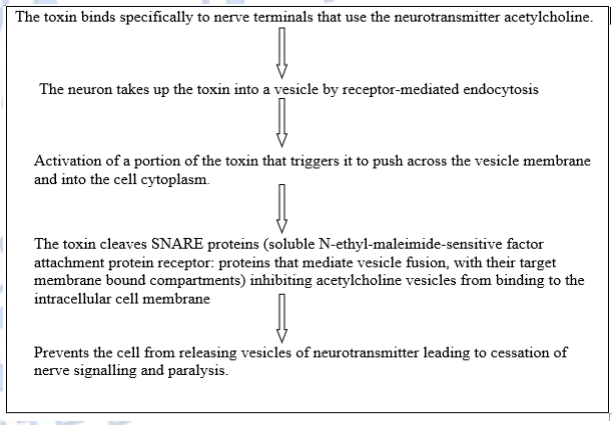
Search strategy:

This article aims to offer an overview of the use of botulinum toxin in treating excessive gingival display in a simple and effective manner. Articles were searched through MEDLINE database and Google scholar search engine. The keywords 'gummy smile', 'excessive gingival display', 'botulinum toxin', 'botox' , 'botox in dentistry', 'botox in gummy smile' and 'botulinum toxin in gummy smile' were searched. A total of 42 articles were retrieved for the purpose of writing this publication of which 25 were selected that described various aspects related to the topic of interest.

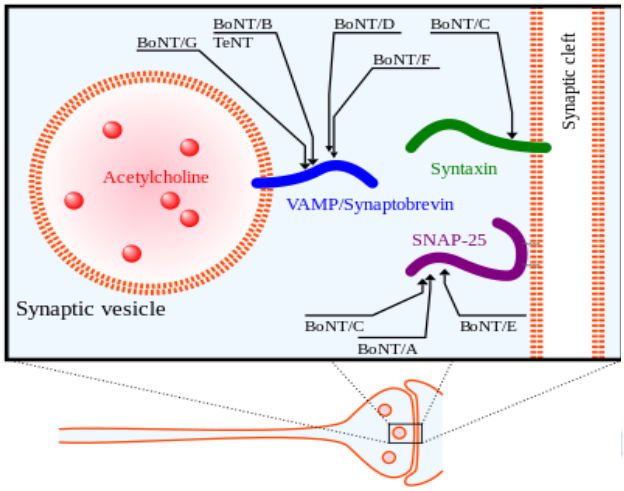
Role of Botulinum toxin in treatment of excessive gingival display / gummy smile

Excessive gingival display or "Gummy smile" is one of the main concerns while treating a patient undergoing esthetic correction. Multiple aetiologic factors have been suggested including short lip length, hyperactive muscles of lip, short clinical crown, vertical maxillary excess and gingival hyperplasia.[5] Various surgical procedures are performed for correction of the excessive display of gingiva followed by esthetic restoration of teeth in the esthetic zone. Surgical procedures may lead to some untoward results such as scar tissue formation and relapse. A minimally invasive modality or non-surgical procedure is found to be advantageous in many cases. The use of botulinum toxin as an adjunct alongwith surgical procedure such as crown lengthening has been shown to give satisfactory outcome.[6] The application of Botulinum neurotoxin counteracts the muscular hyperactivity and reduces the extent of gingival display. [7]

Mechanism of action:



Target molecules of botulinum neurotoxin (abbreviated BoNT) and tetanus neurotoxin (TeNT), toxins acting inside the axon terminal.[8]



Reconstitution and Dilution Recommendations

Two of the most widely accepted toxins for cosmetic reconstruction are Botox and Dysport. 100 units of Botox and Dysport contain 0.73 ng and 0.65 ng botulinum toxin type A respectively.[9] They are available as lyophilized powder that requires to be reconstituted using manufacturer's instructions. The unit dosages of Dysport range from 3 - 4 times higher than the same portions of Botox when used to treat same conditions.[10] The vial should not be shaken as it can cause denaturation of protein leading to its ineffectiveness. These are reconstituted with sterile, non-preserved saline solution and stored at 2°C to 8°C.[11] The lyophilized Botox and Dysport are reconstituted with saline to yield a final concentration of 5 units/0.1 mL and 12.5 units/0.1 mL respectively for cosmetic applications.

Anatomical considerations, injection sites and dosages

Hyperfunction of muscle that raises the upper lip (lip elevators) can lead to excessive gingival display.[12] The lip elevators includes levator labii superioris, zygomaticus major and depressor septi nasi.

The following are the muscle groups, their injection sites (assessed externally) and the dosage.

i. **Levator Labii Superioris**

The levator labii superioris muscle (Figure 1) is a three-part muscle that courses alongside the lateral aspect of the nose, primarily helping in elevation of the upper lip.

The medial portion, levator labii superioris alaeque nasi muscle (LLSAN) is further subdivided into nasolabial, alar and a lip portion. The origin of the LLSAN is the superior anterior process of the maxilla, just above or below the medial palpebral ligament and the muscle inserts into the facial soft tissue lateral to the nostril and upper lip.

The central/intermediate portion (quadratus labii muscle) arises from the lower margin of the orbit directly above the infraorbital foramen. The attachment is mostly to the maxilla, with a few of the other fibers attaching to the zygomatic bone. The fibers insert into the dermis of the upper lip between the LLSAN and the levator anguli oris.

The lateral portion, the zygomaticus minor muscle, arises from the malar surface of the zygomatic bone directly behind the zygomaticomaxillary suture and heads downward and medially in the direction of the upper lip.[13]

INJECTION SITE:

The main site of injection is LLSAN. During injection, use the index finger of the non-injecting hand to firmly press against the inferior portion of the nasal bone where it meets the maxilla. Thus, half of the finger is falling into the pyriform aperture while the other half lies in the groove between the nasal bone and maxilla. Then ask the patient to smile strongly – the levator labii superioris alaeque nasi can usually be felt just lateral to

this groove. It is injected once on each side, just above the periosteum.

Additionally, one injection on each side is given at the junction of the zygomaticus minor and quadrates labii muscle which can be located 10 mm inferior and 5 mm lateral to ala of the nose.[6,7]

DOSAGE:

1.25 U per side is injected in LLSAN under sterile condition whereas 1.25 U per side is administered at the junction of zygomaticus minor and quadrates labii muscle.

ii. **Orbicularis oris**

It is partially derived from the fibers of other facial muscles such as buccinator that forms the deeper layers of orbicularis oris which are inserted into the lips and partly from fibers proper to the lips.[14]

INJECTION SITE:

2 to 3 mm inferior to the nostrils and 2 to 3 mm lateral to the midline (Figure 2).[6]

DOSAGE:

1.25 U on each side is injected at the origin of the depressor septi nasi muscle and the orbicularis oris muscle.

A cold pack is applied on the area to be treated for approximately 1 to 2 minutes to provide adequate topical anesthesia prior to injection. The gel pack is then removed and the injection sites are cleansed with alcohol prep pads to prevent cutaneous infection. A 1 cc syringe with 25 gauge needle is used to withdraw the toxin from the vial and then the needle is exchanged with a 30 or 32 gauge needle which is used for injection. While injecting the needle bevel should be kept upwards and the concentrate should be injected slowly.[15] The patient is reclined about 25 to 30 degrees from the vertical upright position to facilitate proper injection technique. The hypodermic needle should be changed atleast twice as the total injection sites are six in number.[16] The patient is instructed to follow up for retreatment in approximately 3 to 4 months or once it is felt that the muscle activity has returned to approximately 75% of its original strength.[14]

Complications of botulinum toxin injection

There are two types of adverse events reported: transient and benign events, and potentially serious events.[17]

Most of them are injection site adverse effects. Ecchymosis or bruising being the most common arising from injuring a blood vessel at the site of the injection.[18] Hematoma is one of the serious short term complications that requires prevention from the formation of abscess with antibiotics. These can be managed by applying pressure at the time of bleeding. Also, the ice pack should be used immediately after injury to blood vessels. Patient should be asked to avoid intake of vitamin E, aspirin and NSAIDs for a period of 10-14 days before treatment appointment.[19] Localised pain, skin reactions, headache, hypoesthesia and infections are among the other transient adverse effects.

The potentially serious events are sequelae to the systemic spread of toxin leading to botulism-like features or systemic anaphylactic reactions. The cosmetic use of botulinum toxin rarely causes severe side effects such as dysphagia, muscle weakness and allergic reactions, muscle weakness being the most common. The frequency of serious side effects is 33 times higher for therapeutic than for cosmetic cases.[20]

Results with this therapy is not immediate as the improvement is seen after a waiting

period of 2 to 3 days. The elevation of upper lip gradually decreases and the complete effect is attained 14 days post-treatment.

Contraindications

Use of Botox has no absolute contraindications. Relative contraindications include patients younger than 12 years, pregnant or lactating women, individuals with neuromuscular diseases (eg.myasthenia gravis, Lambert-Eaton syndrome) or motor neuron diseases, patients with history of previous reaction to the toxin, patients having a job that requires them to be demonstrative and individuals with exaggerated facial expressions.[21] Botox is contraindicated if the patient is hypersensitive to albumin, botulinum toxin or any component of the formulation. Another contraindication is infection at the proposed injection site(s). Higher doses or more frequent administration may result in neutralizing antibody formation and loss of efficacy. [22]

Conclusion

There are several ways to treat a patient with excessive gingival display. With the advent of botulinum toxin type A, it has shown some successful and predictable outcome when used alone or as an adjunct to other treatment techniques. This ‘miracle poison’ is a minimally invasive and patient friendly option. Although it has a transitory effect of 3-6 months, literature has shown that even after months post treatment the “gummy smile” was still seen to be within normal range.[23] Compared with botulinum toxin type A alone, combination therapy of botulinum toxin type A and hyaluronic acid filler for facial rejuvenation has shown better clinical efficacy, longer lasting effect even in smaller dosages and more satisfied patients. The success of the combination therapy is attributed to the synergistic effect of the two agents. Botulinum toxin type A reduces the muscle contraction thus significantly reducing the absorption of hyaluronic acid fillers leading to longer period of effect and reduced dosage of the toxin.[24,25]

Conflict of interest

None.

References

1. Montecucco C, Molgó J. Botulinal neurotoxins: revival of an old killer. Current opinion in pharmacology. 2005 Jun 1;5(3):274-9.
2. Figgitt DP, Noble S. Botulinum Toxin B. Drugs. 2002 Mar;62(4):705-22.
3. Bayet K, Chikhani L, Ejeil AL. Therapeutic uses and efficacy of botulinum toxin in orofacial medicine. Journal of Oral Medicine and Oral Surgery. 2018 Jan 1;24(1):11-21.
4. Arnon SS, Schechter R, Inglesby TV, Henderson DA, Bartlett JG, Ascher MS, Eitzen E, Fine AD, Hauer J, Layton M, Lillibridge S. Botulinum toxin as a biological weapon: medical and public health management. Jama. 2001 Feb 28;285(8):1059-70.
5. Dym H, Pierre 2nd R. Diagnosis and treatment approaches to a" Gummy Smile. Dent Clin North Am. 2020 Apr 1;64(2):341-49.
6. Polo M. Botulinum toxin type A in the treatment of excessive gingival display. American journal of orthodontics and dentofacial orthopedics. 2005 Feb 1;127(2):214-8.
7. Gracco A, Tracey S. Botox and the gummy smile. Progress in orthodontics. 2010 May 1;11(1):76-82.
8. Barr JR, Moura H, Boyer AE, Woolfitt AR, Kalb SR, Pavlopoulos A, McWilliams LG, Schmidt JG, Martinez RA, Ashley DL. Botulinum neurotoxin detection and differentiation by mass

spectrometry. Emerging infectious diseases. 2005 Oct;11(10):1578.
9. Frevert J. Content of botulinum neurotoxin in botox®/vistabel®, dysport®/azzalure®, and xeomin®/bocouture®. Drugs in R & D. 2010 Jul;10(2):67-73.
10. Odergren T, Hjaltason H, Kaakkola S, Solders G, Hanko J, Fehling C, Marttila RJ, Lundh H, Gedin S, Westergren I, Richardson A. A double blind, randomised, parallel group study to investigate the dose equivalence of Dysport® and Botox® in the treatment of cervical dystonia. Journal of Neurology, Neurosurgery & Psychiatry. 1998 Jan 1;64(1):6-12.
11. Allen SB, Goldenberg NA. Pain difference associated with injection of abobotulinumtoxinA reconstituted with preserved saline and preservative-free saline: a prospective, randomized, side-by-side, double-blind study. Dermatologic surgery. 2012 Jun;38(6):867-70.
12. Peck S, Peck L, Kataja M. The gingival smile line. The Angle Orthodontist. 1992 Jun;62(2):91-100.
13. Bloom J, Lopez MJ, Rayi A. Anatomy, Head and Neck, Eye Levator Labii Superioris Muscle.
14. Lipham WJ. Cosmetic and clinical applications of botox and dermal fillers. Slack Incorporated; 2008.
15. Ward NL, Kavlick KD, Diaconu D, Dawes SM, Michaels KA, Gilbert E. Botulinum neurotoxin A decreases infiltrating cutaneous lymphocytes and improves acanthosis in the KC-Tie2 mouse model. The Journal of investigative dermatology. 2012 Jul;132(7):1927.
16. Insulin: Reusing Syringes and Lancets Safely; University of Michigan Health, Michigan Medicine.
17. Witmanowski H, Błochowiak K. The whole truth about botulinum toxin–a review. Advances in Dermatology and Allergology/PostępyDermatologiiiAlergologii. 2020 Dec;37(6):853.
18. Vartanian AJ, Dayan SH. Complications of botulinum toxin A use in facial rejuvenation. Facial Plastic Surgery Clinics. 2003 Nov 1;11(4):483-92.
19. Shetty M, Force ID. Guidelines on the use of botulinum toxin type A. Indian journal of dermatology, venereology and leprology. 2008 Jan 1;74(1):13.
20. Coté TR, Mohan AK, Polder JA, Walton MK, Braun MM. Botulinum toxin type A injections: adverse events reported to the US Food and Drug Administration in therapeutic and cosmetic cases. Journal of the American Academy of Dermatology. 2005 Sep 1;53(3):407-15.
21. Dastoor SF, Misch CE, Wang HL. Botulinum toxin (Botox) to enhance facial macroesthetics: a literature review. Journal of Oral Implantology. 2007 Jun;33(3):164-71.
22. Carruthers J, Carruthers A. Complications of botulinum toxin A. *Facial PlastSurg Clin North Am*. 2007;15:51-54
23. Dinker S, Anitha A, Sorake A, Kumar K. Management of gummy smile with Botulinum Toxin Type-A: A case report. Journal of international oral health: JIOH. 2014 Feb;6(1):111.
24. Nanda S, Bansal S. Upper face rejuvenation using botulinum toxin and hyaluronic acid fillers. Indian J Dermatol VenereolLeprol. 2013 Jan 1;79(1):32-40.
25. Zhang W, Xie Y, Liu W, Lei J, Liu Y. Combination therapy of botulinum toxin type A and hyaluronic acid filler for facial rejuvenation. Int J Clin Exp Med. 2018 Jan 1;11(5):5033-8.

FIGURES:

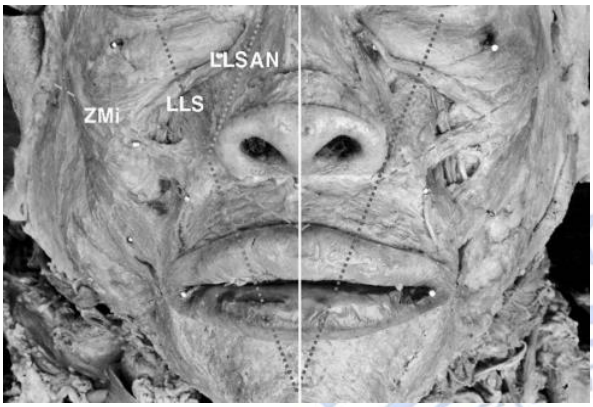


FIGURE 1: Photograph of dissected specimen with vectors showing the direction of muscle fibres.

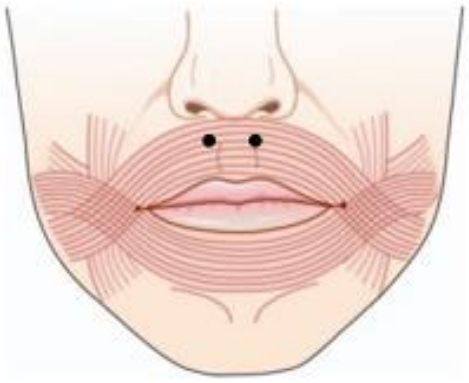


FIGURE 2: Injection sites for orbicularis oris muscle